

THAT WHICH IS CLAIMED:

1. An ultrasonic welding apparatus for joining at least one component, the ultrasonic welding apparatus comprising:
  - an ultrasonic transducer adjacent the component;
  - a magnetic source providing a magnetic field, wherein the magnetic source is proximate the ultrasonic transducer; and
  - a ferromagnetic device opposite the component from the magnetic source and the ultrasonic transducer;wherein the magnetic field of the magnetic source supports the ferromagnetic device so that the component is positioned between the ultrasonic transducer and the ferromagnetic device.
2. An ultrasonic welding apparatus according to Claim 1 wherein the ferromagnetic device defines a generally spherical outer surface.
3. An ultrasonic welding apparatus according to Claim 2 wherein the ferromagnetic device comprises a steel sphere.
4. An ultrasonic welding apparatus according to Claim 2 wherein the ferromagnetic device comprises a magnet.
5. An ultrasonic welding apparatus according to Claim 1 wherein the magnetic source provides an adjustable magnetic field, such that a change in the magnetic field of the magnetic source changes a compressive force the ferromagnetic device applies to the component.
6. An ultrasonic welding apparatus according to Claim 5 wherein the magnetic source comprises an electromagnet.
7. An ultrasonic welding apparatus according to Claim 1 wherein the ultrasonic transducer defines a first side and a second side opposite the first side, and wherein the magnetic source comprises a first electromagnet proximate the first side of the ultrasonic transducer and a second electromagnet proximate the second side of the ultrasonic transducer, such that the first and second electromagnets are located an equivalent distance from the respective sides of the ultrasonic transducer.

8. An ultrasonic welding apparatus according to Claim 1 wherein the ultrasonic transducer comprises an ultrasonic horn located between the ultrasonic transducer and the component.

9. An ultrasonic welding apparatus according to Claim 8 wherein the component engages the magnetic source and the ultrasonic horn during the joining of the component.

10. A method of ultrasonically joining at least one component, comprising the steps of:

positioning the component to be adjacent an ultrasonic transducer such that the ultrasonic transducer and a magnetic source are on a common side of the component;

providing a ferromagnetic device on a side of the component opposite the ultrasonic transducer and the magnetic source;

applying a magnetic field from the magnetic source, such that magnetic field of the magnetic source supports the ferromagnetic device so that the component is positioned between the ultrasonic transducer and the ferromagnetic device; and

transmitting an ultrasonic signal from the ultrasonic transducer to join the component.

11. A method according to Claim 10 wherein providing a ferromagnetic device comprises providing a generally spherical ferromagnetic device.

12. A method according to Claim 11 wherein providing a ferromagnetic device comprises providing a steel sphere.

13. A method according to Claim 11 wherein providing a ferromagnetic device comprises providing a magnet that defines a generally spherical surface.

14. A method according to Claim 10 wherein applying a magnetic field comprises generating an adjustable magnetic field, such that a change in the magnetic field of the magnetic source changes a compressive force the ferromagnetic device applies to the component.

15. A method according to Claim 14 wherein applying a magnetic field comprises generating the adjustable magnetic field from an electromagnet.

16. A method according to Claim 10 wherein positioning the component comprises providing the ultrasonic transducer between a first electromagnet proximate a first side of the ultrasonic transducer and a second electromagnet proximate a second side of the ultrasonic transducer, such that the first and second electromagnets are located an equivalent distance from the respective sides of the ultrasonic transducer.

17. A method according to Claim 10 wherein positioning the component comprises positioning the component such that the component engages an ultrasonic horn of the ultrasonic transducer and engages the magnetic source.

18. A method according to Claim 10, further comprising the step of advancing the component relative to the ultrasonic transducer as the ultrasonic transducer transmits the ultrasonic signal to define a joint along the component.